KASHCHEYEV, N.B.

Ways to improve the sprinkling systems. Pozh. bezop. no.3:103-132 '64. (MIRA 18:5)

KASHCHEYEV, N. F. DECEASED 1962/7

c. '62

Chemistry

see ILC

KASHCHEYEV, N.F.

SEVCENKO, V.B. [Shevchenko, V.B.]; ZOLOTUCHA, S.I. [Zolotukha, S.I.]; KASCEJEV, N.F. [Kashcheyev, N.F.]; CAREV, S.A. [TSarev, S.A.]; MICHAJLOV, A.A. [Mikhaylov, V.A.]; TOROPCENOVA, G.A. [Toropchenova, G,A,]; MANCIK, M. [translator]

Complex utilization of uranium ores. Jaderna energie 4 no.11: 338-341 N '58.

L 39814-66 EWT(m)/EPF(n)-2 JD/WW/GD-2/JG
ACC NR: AP6011009 (N) SOURCE CODE: UR/0080/66/039/003/0513/0522

13

AUTHOR: Ukrayntsev, Ye. V.; Kashcheyev, N. F.

B

ORG: none

TITLE: Extraction of thorium with diisoamyl methylphosphonate from nitric acid solutions

21 21

SOURCE: Zhurnal prikladnoy khimii, v. 39, no. 3, 1966, 513-522

TOPIC TAGS: thorium, metal extracting, partition coefficient

ABSTRACT: The extractive properties of diisoamyl methylphosphonate (DAMP) in the extraction of thorium from nitric acid solutions were studied. Since water and nitric acid are integral parts of these systems, their extraction with DAMP was also investigated. The diluents employed for the extracting agent were benzene, p-xylene, and CCl_4. DAMP solutions in xylene and benzene were found to be more effective extractants than tributyl phosphate. Extraction of HNO_3 with DAMP involves the formation of the complex $HNO_3 \cdot H_2O \cdot DAMP$ with $K = 0.41 \pm 0.03$. Extraction of H_2O involves formation of a complex of the composition $n \cdot H_2O \cdot DAMP$, where n depends on the DAMP

2

Card 1/2 UDC: 546.841' + 542.61

KASHCHEYEV, N.T.; SPITSYN, M.A.; VUKOLOV, L.A., st. nauchn. sotr., kand. tekhn. nauk, retsenzent; USPENSKIY, V.I., kand. tekhn. nauk, retsenzent; BRAYLOVSKIY, N.G., inzh., red.; VOROB'YEVA, L.V., tekhn. red.

[Skidding of wheel pairs and measures for its prevention] Zaklinivanie kolesnykh par i mery ego preduprezhdeniia. Moskva, Izd-vo "Transport," 1964. 175 p. (MIRA 17:3)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut transportnogo stroitel'stva (for Vukolov).

KASHCHEYEV, N.V., inzh.

Prefabrication techniques and mechanization of construction operations in the White Russian S.S.R. Mekh.stroi. 18 no.9:1-4 S '61. (MIRA 14:10)

1. Zamestitel' Ministra stroitel'stva BSSR.
(White Russia--Construction industry)

KASHCHEYEV, N.V., inzh.

Utilization of construction equipment at construction projects in White Russia. Mekh.stroi. 19 no.7:10-11 Jl '62. (MIRA 15:7)
(White Russia--Construction equipment)

KASHCHEYEV, S.A., inzh.

Hinged cars for overhead conveyors. Vest.mashinostr. 43 no.2:76-77 F '63. (MIRA 16:3)

(Conveying machinery)

CA KASHCHEYEV

Calculations of distillation of multi-component hydrocarbon mixtures. V. Kashcheev. *Org. Chem. Ind.* (U. S. S. R.) 1, 416-23(1936).—A discussion with math. treatment. Fifteen references. Chas. Blanc

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

SOV/44-58-4-2989

Translation from: Referativnyy zhurnal, Matematika, 1958, Nr 4, p 81 (USSR)

AUTHOR: Kashcheyev, V.

TITLE: On Properties of Certain Solutions of the Bethe-Salpeter Equation (O svoystvakh resheniy uravneniya Bete-Sal'petera)

PERIODICAL: Student. zinatniskie darbi. Latv. Univ., nauchn. stud. raboty, Latv. un-t, 1957, sb. 2, pp 34-40

ABSTRACT: A study is made of certain properties of the Bethe-Salpeter (BS) equation, which is one of the formalisms in quantum field theory not using the perturbation theory. The BS equation was solved with the following assumptions: a) half of the total energy of the bound unit of two fermions E=0; b) the rest mass of a quantized field μ=0; c) the BS wave function in the impulse space is proportional to the unit matrix: $\Phi(p) \sim J$. It is shown that the first condition is taken not simply for

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SOV/44-58-4-2989

On Properties of Certain Solutions (Cont.)

convenience, but follows necessarily from the requirement of the simultaneousness of the equations under condition c). Green (RZhMat, 1956, 2271) showed the absence of a spectrum in the case $\Phi(p) \equiv \Phi(p^2)$. In the present work the error of his reasoning is shown and the presence of the spectrum is proven. Besides the possibility of deriving the point spectrum of the eigenvalues from a continuous spectrum, by means of drawing on additional physical considerations the purely mathematical possibilities of the existence of a discrete spectrum (equally possible with a continuous spectrum) are also shown. Higher approximations in the BS equation may be considered by substitution in the staircase approximation equation of single-particle Greenians for modified Green functions.

Ye. S. Alekseyev

Card 2/2

ACCESSION NR: AP4009277 S/0197/63/000/011/0063/0071

AUTHOR: Kashcheyev, V.

TITLE: On the theory of infrared light absorption in crystals

SOURCE: AN LatSSR. Izv., no. 11, 1963 63-71

TOPIC TAGS: cubical anharmonism, infrared absorption, classical theory, radiation frequency, electric dipole moment, Green function, Fourier transform, ionic crystal

ABSTRACT: The cubical anharmonism in the general theory of infrared absorption in ionic crystals has been studied according to the classical theory. The linear absorption coefficient in the classical limit $(\hbar \to 0)$ has the form

$$\chi_{\alpha\beta}(\omega) = \beta V^{-1} \lim_{\varepsilon \to +0} \int_0^\infty d\tau e^{-i\omega\tau - \varepsilon\tau} < \dot{M}_\alpha(0) M_\beta(\tau) >$$

where ω - absorbed radiation frequency, V - crystal volume, M(t) - electric dipole moment of crystal. To calculate the correlator in the above expression the normal lattice coordinates $\{q_{kj}\}$ and the canonical momentum coordinates $\{p_{kj}\}$ are used. These are then transformed to the following complex normal coordinates:

ACCESSION NR: AP4009277

$$\left.\begin{aligned} P_{kj} &= \sqrt{\frac{\omega_{kj}}{2}}\, q_{kj} + \frac{i}{\sqrt{2\omega_{kj}}}\, p_{kj} \\ Q_{kj} &= \sqrt{\frac{\omega_{kj}}{2}}\, q_{kj} - \frac{i}{\sqrt{2\omega_{kj}}}\, p_{kj} = P_{kj}^{*} \end{aligned}\right\}.$$

This leads to an expression for the absorption coefficient given by

$$\varkappa_{\alpha\beta}(\omega) = \frac{2\pi\omega\beta}{vc} \sum_{jj'} \sqrt{\frac{\omega_{oj}}{\omega_{oj'}}}\, M_{oj}^{\alpha}\, M_{oj'}^{\beta} \times$$

$$\times Im\left\{ i \int_{0}^{\infty} d\tau\, e^{-i\omega\tau - \varepsilon\tau} \sum_{n=1}^{4} (-1)^{n-1} K_{jj'}^{(n)}(0,\tau) \right\},\ \varepsilon \to +0.$$

The correlator $K_{jj}^{(n)}(0,\tau)$ is then represented by a two-time variable Green's function given by $_{1}G_{jj'}^{(1)}(\tau, t) = -i\theta(\tau - t) < [P_{oj'}(\tau), P_{oj}(t)] > = \ll P_{oj'};\ P_{oj} \gg$ where $_{s}G_{jj'}^{(n)}$ is isomorphic in the sense of correlator $K_{jj}^{(n)}(t,\tau)$. The Fourier transform of the Green's function is given, and equations of motion for the Green's

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ACCESSION NR: AP4009277

function are derived and substituted back into the Fourier transform expression of the linear absorption coefficient. It is shown that operating with the two-time variable temperature Green's function one can postulate with relative ease, along with quantum and classical considerations, the infrared light absorption problem of ionic crystals. Orig. art. has: 39 equations.

ASSOCIATION: Institut fiziki AN Latv. SSR (Institute of Physics, AN Latvian SSR)

SUBMITTED: 19Jun63 DATE ACQ: 03Feb64 ENCL: 00

SUB CODE: GP, OP NO REF SOV: 012 OTHER: 004

Card 3/3

KASHCHEYEV, V.

Theory of infrared absorption of light in crystals. Izv. AN Latv.SSR no.11:63-71 '63. (MIRA 17:4)

1. Institut fiziki AN Latviyskoy SSR.

BILENSKIY, V.; KASHCHEYEV, V.

Effect of domain bounderies on the scattering of slow neutrons in the uniaxial ferromagnetic. Vestis Latv ak no.3:39-43 '62.

1. Institut fiziki AN Latviyskoy SSR.

KASHCHEYEV, V.

Theory of magnetic neutron scattering on an impurity center in a crystal. Vestis Latv ak no.7:53-56 '62.

1. Institut fiziki AN Latviyskoy SSR.

MILICHENKO, S.L., inzh.; RAZIKOV, M.I., kand. tekhn. nauk; KOCHEVA, G.N., inzh.; KASHCHEYEV, V.A., inzh.; FRANTSUZOV, D.M., inzh.

Repair of the rotor wheel of a hydraulic turbine using built-up welding with a cavitation resistant layer. Elek. sta. 35 no.5:37-41 My '64. (MIRA 17:8)

KASHCHEYEV, V.A., inzh.

Performance of rubber baffle packings of the main shaft of a hydraulic turbine. Elek. sta. 35 no.11:72-73 N '64. (MIRA 18:1)

KHASIN, A.Z.; MERKULOVA, N.S.; KASHCHEYEV, V.D.

Square pulse generator for electrochemical investigations.
Elektrokhimiia 1 no.9:1142-1145 S '65. (MIRA 18:10)

1. Institut elektrokhimii AN SSSR.

K...CHEYEV, V.D.; KABANOV, B.N.; LEYKIS, D.I.

Anode activation of iron. Dokl. AN SSSR 147 no.1:143-145 N '62. (MIRA 15:11)

1. Institut elektrokhimii AN SSSR. Predstavleno akademikom A.N. Frumkinym.

(Iron)
(Electrodes)

L 17544-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3004429 S/0020/63/151/004/0883/0885

AUTHORS: Kabanov, B. N.; Kashcheyev, V. D.

59

58

TITLE: The mechanism of anodic activation of iron.

SOURCE: AN SSSR. Doklady, v. 151, no. 4, 1963, 883-885.

TOPIC TAGS: anodic activation, valence, iron, passive iron, anodic dissolution, perchloric acid, Fe sup 2 plus, Fe sup 3 plus, ClO sup minus sub 4, oxygen.

ABSTRACT: Authors determined the influence of the composition of the solution on anodic activation and on the valence of iron going into solution during anodic acitivation of passive iron in order to explain the mechanism of anodic dissolution of iron. In perchloric acid more than 99% of the current goes into the formation of Fe^{2+} ions and less than 1% into that of Fe^{3+} and ClO_4^- ions do not accelerate the rate of formation of Fe^{3+} ions. Authors concluded that ClO_4^- ions are capable of either strongly retarding the reaction $Fe^{2+} \rightarrow Fe^{3+}$ or, more probably, do not displace oxygen from the surface but only regroup it, and the anodic oxidation of Fe^{2+} proceeds on a small portion of the surface. "We wish to thank D. I. Leykis and B. M. Grafov for their participation in discussing the results of the experiments." Orig. art. has: 3 figures and 2 formulas.

ASSOCIATION: Institute of Electrochemistry, Academy of Sciences, SSSR.

Card 1/2

KASHCHEYEV, V. D., DOCENT.

Cheremkovo - Coal Mines and Mining

Use of the chamber-pillar mining system in the lower seam of the "Glavnyi" stratum in the Cheremkhovo district of the Irkutsk Basin. Nach. trudy Mosk. gor. inst., no. 8, '50.

Monthly List of Russian Accessions, Library of Congress, October 1952. UNCLASSIFIED.

KASHCHEYEV, Vasiliy Dmitriyevich; BOYKO, A.A., otv.red.; ZHUKOV, V.V., red.izd-va; MINSKER, L.I., tekhn.red.

[Underground coal mining systems] Sistemy podzemnoi razrabotki ugol'nykh mestorozhdenii. Moskva, Gos.nauchno-tekhn.izd-vo lit-ry po gornomu delu, 1961. 70 p. (MIRA 14:6)
(Coal mines and mining)

KASHCHEYEV, V.I.

504,3 meters of reinforced concrete lining of a skip shaft completed in one month. Ugol' Ukr. 2 no.2:27-30 F '58. (MIRA 13:3)

1. Nachal'nik proizvodstvenno-tekhnicheskogo otdela vtorogo parokhodcheskogo upravleniya tresta Stalinshakhtoprokhodka.
(Shaft sinking)

drical or spherical cavity. It is assumed that there ... (temperature ... the inner surface of the body, that there is ideal contact ... between the outside

of the body ... The solution of the heat transfer equation can be expressed in the form law. The solution of the heat transfer equation

$$X_{in}(r) = C_{in}\varphi_{in}(r) + D_{in}\psi_{in}(r).$$

... linearly independent and are

respectively for plates, $J_0\left(\frac{\mu_n}{a_l} r\right) \;\Big|\; Y_0\left(\frac{\mu_n}{a_l} r\right)$

for cylinders, and $\frac{1}{r}\sin\left(\frac{\mu_n}{a_l} r\right) \;\Big|\; \frac{1}{r}\cos\left(\frac{\mu_n}{a_l} r\right)$

for spheres. After using the boundary conditions to obtain 2k arbitrary constants ... the solution into the ... differential equation, the

... the eigenvalues or roots of the determinant of the coefficient matrix. ... example, this equation is applied to find the temperature distribution in two ... with heat generation in the outside ... Orig. art. has: ... tables, and 30 formulas.

... Engineer-

L 10474-65

ACCESSION NR: AP4047443

SUBMITTED: 20Aug63 ENCL: 00

KASHCHEYEV, V. M

AUTHOR: Kashcheyev, V. M. (Leningrad) 24-2-8/28

TITLE: The dynamic balancing of rotors by the swinging method. (Dinamicheskaya balansirovka rotorov metodom kachaniy).

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, No.2, pp.51-57 (USSR)

ABSTRACT: The rotor is suspended by one shaft end with the help of a trunion member so that it is capable of pendular swinging and rotation about its own axis. At rest, a statically balanced rotor will hang so that its axis is vertical. Pendular oscillations of the first kind are those initiated by releasing the rotor after displacing its axis from the vertical. Oscillations of the second kind are initiated by a shaft impact imparting suddenly a certain angular velocity in the position of equilibrium. If the rotor is dynamically balanced and possesses "kinetic" symmetry (equal moments of inertia) it will swing like a physical pendulum, otherwise its motion will be accompanied by rotation about its axis. Observation of the rotation about the rotor axis reveals dynamic unbalance and kinetic dissymmetry. Small unbalance or dissymmetry permit simplifications in the equations of motion. Expressions are given from which the

Card 1/3

kind and measuring the angular displacement of this line and the time it takes. These data yield the kinetic dissymmetry. In pendular motion of the second kind, the dynamically unbalanced but kinetically symmetrical rotor rotates in the same sense about its own axis. In the absence of friction, the mean angular velocity is constant and is proportional to the product of inertia (a measure of dynamic unbalance). In the presence of friction, the

Card 2/3

The dynamic balancing of rotors by the swinging method. 24-2-8/28

initial angular velocity is sufficiently close to the frictionless velocity. The residual unbalance is proportional to the coefficient of friction of the rotor shaft, to the mass of the rotor, and the square of its radius of gyration. Laboratory experiments have confirmed the theory presented.
There are 10 figures and 4 references, all of which are Russian.

SUBMITTED: February 7, 1957.

AVAILABLE: Library of Congress.

Card 3/3

KASHCHEYEV, V.M., insh.

Dynamic balancing of rotors by the method of swinging. Sbor. nauch. trud. LISI no.3:186-201 '59. (MIRA 13:7)
(Rotors)

S/124/62/000/006/005/023
D234/D308

26.2120

AUTHOR: Kashcheyev, V. M.

TITLE: Dynamic balancing of rotors by means of swinging

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 6, 1962, 26, abstract 6A191 (Sb. nauchn. tr. Leningr. inzh-stroit. in-t. 1959, no. 30, 186-201)

TEXT: The basis is given of the swinging method for detecting and estimating the dynamic unbalance of rotors whose form is close to an ideal body of rotation. The author investigates the oscillations of an unbalanced, kinetically asymmetrical rotor, one of the points of its shaft being rigidly fixed in a Cardan suspension. It is shown that the rotor, whose equilibrium has been disturbed by displacing its longitudinal axis by a certain small angle from the vertical, will oscillate in the vertical plane and, besides, will carry out rotational oscillations about its longitudinal axis. From the value of the period and the amplitude of these rotational oscillations one can calculate the magnitude of additional masses

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KASHCHEYEV, V. M., Cand Tech Sci -- (diss) "Dynamic balancing of rotors by method of oscillations." Leningrad, 1960. 10 pp; with charts; (Ministry of Higher and Secondary Specialist Education RSFSR, Leningrad Polytechnic Inst im M. I. Kalinin); 150 copies; price not given; (KL, 22-60, 137)

BULAVIN, P.Ye.; KASHCHEYEV, V.M.

Solution of an inhomogeneous equation of heat conduction for multilayer bodies. Inzh.-fiz. zhur. 7 no.9:71-77 S '64. (MIRA 17:12)

1. Fiziko-energeticheskiy institut, Obninsk.

VASSERMAN, Nina Borisovna; KASHCHEYEV, V.M., kand. tekhn. nauk, nauchn. red.; GAPEYEVA, T., red.

[Theoretical mechanics; kinematics of a mass point. Written lectures] Teoreticheskaia mekhanika; kinematika tochki. Pis'mennye lektsii. Leningrad, Severo-Zapadnyi zaochnyi politekhn. in-t, 1965. 51 p. (MIRA 19:1)

KASHCHEYEV, V. N.

KASHCHEYEV, V. N. : "Restoration of the worn parts of machinery and mechanisms of the forestry industry by accretion of high-sulfide coverings." Min Higher Education USSR. Moscow Forestry Engineering Inst. Moscow, 1956. (Dissertation for the Degree of Candidate in Technical Science.)

Knizhnaya letopis', No. 31, 1956. Moscow.

KASHCHEYEV, V.N., kand. tekhn. nauk, dotsent

New method for the reconditioning and strengthening of wornout machine parts. Nauch. trudy MTILP no.24:249-263 '62. (MIRA 16:7)

1. Kafedra tekhnologii metallov Moskovskogo tekhnologicheskogo instituta legkoy promyshlennosti.

(Hard facing)

OSHURKOV, P.(Riga); KASHCHEYEV, V.(Riga); CHESTNYKH, L.(Riga)

Ferromagnetic cylinder in the constant magnetic field. Vestis Latv ak no.8:63-72 '60. (EEAI 10:9)

1. Akademiya nauk Latviyskoy SSR, Institut fiziki.

(Magnetic fields)

23121

S/181/61/003/005/026/042
B108/B209

24,7100(1160,1136,1142)

AUTHORS: Kashcheyev, V. N. and Krivoglaz, M. A.

TITLE: Effect of anharmonism upon the energy distribution of inelastically scattered neutrons. I. The case of a weak bond

PERIODICAL: Fizika tverdogo tela, v. 3, no. 5, 1961, 1528-1540

TEXT: In studying the scattering of slow monochromatic neutrons, the authors confine themselves to single-phonon scattering from a perfect crystal. Neutron absorption and magnetic scattering are neglected. The expression for the differential scattering cross section of the above neutrons is divided into two portions, corresponding to coherent and incoherent scattering:

$$\sigma_c(\mathbf{q}_1, \omega) = CN\frac{k_2}{k_1}\sum_{jj'}\frac{Q_{j'\mathbf{q}_1}Q^*_{j\mathbf{q}_1}}{\sqrt{\omega_{\mathbf{q}j}\omega_{\mathbf{q}j'}}}[\varphi'_{\mathbf{q}j\mathbf{q}j'}(\omega) + \varphi''_{\mathbf{q}j\mathbf{q}j'}(\omega)], \quad (5)$$

$$\sigma_i(\mathbf{q}_1, \omega) = C\frac{k_2}{k_1}\sum_{jj'}\sum_{\mathbf{k}}\frac{S_{jj_1}(\mathbf{k})}{\sqrt{\omega_{\mathbf{k}j}\omega_{\mathbf{k}j'}}}[\varphi'_{\mathbf{k}j\mathbf{k}j'}(\omega) + \varphi''_{\mathbf{k}j\mathbf{k}j'}(\omega)]. \quad (6),$$

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where

$$\left.\begin{aligned} C &= \frac{m^2}{8\pi^2\hbar^4\rho v}; \\ Q_{jq_1} &= \sum_{\gamma} \bar{A}_{\gamma}(q_1 e_{qj\gamma}) e^{2\pi i K_n R_{s\gamma}} \\ S_{jq_1}(k) &= \sum_{\gamma} |q_1 e_{kj\gamma}|^2 \left[\overline{(A_{s\gamma} - \bar{A}_{\gamma})^2} + \overline{B^2_{s\gamma}}\right]. \end{aligned}\right\} \quad (7);$$

$\bar{A}_{\gamma}$ and $A_{s\gamma} - \bar{A}_{\gamma}$ are the mean and the varying portions of the constant $A_{s\gamma}$ which characterizes the lattice nodes of kind γ. $A_{s\gamma}$ and $B_{s\gamma}$ are the constants in the expression for the interaction energy of slow neutrons with a nucleus at the lattice node $s\gamma$ (s indicates the number of the respective lattice cell). $\vec{q}_1 = \vec{k}_2 - \vec{k}_1$; $\vec{q} = \vec{q}_1 - 2\pi\vec{K}_n$; $\vec{K}_n$ is the vector of the reciprocal lattice; $\vec{R}_{s\gamma}$ is the radius vector of the respective nodes and $\vec{e}_{kj\gamma}$ is the polarization vector. The quantities φ' and φ'' entering Eqs.(5)

and (6) are then determined from the relations

$$\left.\begin{aligned}\varphi'_{kj/kj'}(\omega)&=\frac{1}{2\pi}\int_{-\infty}^{\infty}dte^{-i\omega t}\,\mathrm{Sp}\left\{a_{kj}(t)\,a^{+}_{kj'}(0)\,e^{-\lambda H}\right\}\left(\mathrm{Sp}\,e^{-\lambda H}\right)^{-1},\\ \varphi''_{kj/kj'}(\omega)&=\frac{1}{2\pi}\int_{-\infty}^{\infty}dte^{-i\omega t}\,\mathrm{Sp}\left\{a^{+}_{kj}(t)\,a_{kj'}(0)\,e^{-\lambda H}\right\}\left(\mathrm{Sp}\,e^{-\lambda H}\right)^{-1}.\end{aligned}\right\}\quad(8).$$

Since these quantities are chiefly determined by the dynamical properties of the system, they are calculated from the Hamiltonian as expressed by the creation and annihilation operators. With the help of Green's function according to Ref. 8 (N. N. Bogolyubov, S. V. Tyablikov. DAN SSSR, 126, 53, 1959; D. N. Zubarev. UFN, 71, 71, 1960), the authors obtained

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S/181/61/003/005/026/042
B108/B209

Effect of anharmonism upon the ...

$$\left.\begin{aligned} \varphi''_{\mathbf{k}j\mathbf{k}j}(\omega) &= \frac{1}{\pi}\frac{\Gamma_{\mathbf{k}j}(\omega)\,n(\omega)}{[\omega-\omega_{\mathbf{k}j}-P_{\mathbf{k}j}(\omega)]^2+\Gamma^2_{\mathbf{k}j}(\omega)}, \\ \varphi'_{\mathbf{k}j\mathbf{k}j}(-\omega) &= \frac{1}{\pi}\frac{\Gamma_{\mathbf{k}j}(\omega)\,[n(\omega)+1]}{[\omega-\omega_{\mathbf{k}j}-P_{\mathbf{k}j}(\omega)]^2+\Gamma^2_{\mathbf{k}j}(\omega)}, \end{aligned}\right\} \quad (12)$$

$$\left.\begin{aligned} \varphi''_{\mathbf{k}j'\mathbf{k}j}(\omega) &= \frac{P_{\mathbf{k}jj'}(\omega)\,\varphi''_{\mathbf{k}j'\mathbf{k}j'}(\omega)}{\omega-\omega_{\mathbf{k}j}}+\frac{1}{\pi}\frac{\Gamma_{\mathbf{k}jj'}(\omega)\,n(\omega)}{\omega-\omega_{\mathbf{k}j}}\times \\ &\times\frac{\omega-\omega_{\mathbf{k}j'}-P_{\mathbf{k}j'}(\omega)}{[\omega-\omega_{\mathbf{k}j'}-P_{\mathbf{k}j'}(\omega)]^2+\Gamma^2_{\mathbf{k}j'}(\omega)}, \\ \varphi'_{\mathbf{k}j'\mathbf{k}j}(-\omega) &= \frac{P_{\mathbf{k}jg}(\omega)\,\varphi'_{\mathbf{k}j'\mathbf{k}j'}(-\omega)}{\omega-\omega_{\mathbf{k}j}}+\frac{1}{\pi}\frac{\Gamma_{\mathbf{k}jj'}(\omega)\,[n(\omega)+1]}{\omega-\omega_{\mathbf{k}j}}\times \\ &\times\frac{\omega-\omega_{\mathbf{k}j'}-P_{\mathbf{k}j'}(\omega)}{[\omega-\omega_{\mathbf{k}j'}-P_{\mathbf{k}j'}(\omega)]^2+\Gamma^2_{\mathbf{k}j'}(\omega)}\ (\text{при}\ \omega\simeq\omega_{\mathbf{k}j'}). \end{aligned}\right\} \quad (13),$$

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23121
S/181/61/003/005/026/042
B108/B209

Effect of anharmonism upon the ...

The coefficients at the third-order term in the expansion of the potential energy of the crystal according to the displacement of the atoms, $V^{ikl}_{s\gamma s'\gamma' s''\gamma''}$, enter these relations through the expression

$$V_{\vec{k}j\vec{k}'j'\vec{k}''j''} = \left(\frac{\hbar}{2\rho N_0}\right)^{3/2} \sum_{s\gamma s'\gamma' s''\gamma''} \sum_{ikl} \frac{V^{ikl}_{s\gamma s'\gamma' s''\gamma''} e^{i}_{\vec{k}j\gamma} e^{k}_{\vec{k}'j'\gamma'} e^{l}_{\vec{k}''j''\gamma''}}{\sqrt{\omega_{\vec{k}j}\omega_{\vec{k}'j'}\omega_{\vec{k}''j''}}} \times \tag{10}$$
$$\times \exp\left[i\left(\vec{k}\vec{R}_{s\gamma} + \vec{k}'\vec{R}_{s'\gamma'} + \vec{k}''\vec{R}_{s''\gamma''}\right)\right],$$

The widening of the peaks in the energy distribution of the scattered neutrons, $\Gamma_{\vec{k}j}(\omega)$, is found to be proportional to kT^4 at low temperatures $(\varkappa T \ll h\omega_m)$, and to kT at high temperatures, both in second approximation. ω_m is the maximum frequency of acoustic phonons. Eqs. (14) and (15) show

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that for $j = j'$ for short-wave acoustic and optical phonons, the frequency shift of the phonon vibrations, $P_{\vec{k}j}(\omega)$, is approximately equal to the widening of the scattering peaks. Thus, in rough estimation, $P_{\vec{k}j}(\omega) \simeq 0.1\omega_m$ for low temperatures and $P_{\vec{k}j}(\omega) \simeq 0.1 \frac{\varkappa T}{\hbar}$ for high temperatures. There are 16 references: 10 Soviet-bloc and 6 non-Soviet-bloc. The two references to English-language publications read as follows: G. Placzek, L. van Hove. Phys. Rev., 93, 1207, 1954; M. Cohen, R. P. Feynman. Phys. Rev., 107, 13, 1957.

ASSOCIATION: Institut fiziki AN LSSR (Institute of Physics, AS Latviyskaya SSR), Institut metallofiziki AN USSR Kiyev (Institute of Physics of Metals, AS UkrSSR, Kiyev)

SUBMITTED: November 19, 1960

23122

S/181/61/003/005/027/042
B108/B209

24,7900 (1144, 1158, 1163)

AUTHORS: Kashcheyev, V. N. and Krivoglaz, M. A.

TITLE: Effect of spin-spin and spin-phonon interaction in a ferromagnetic on the energy distribution of scattered neutrons.

PERIODICAL: Fizika tverdogo tela, v. 3, no. 5, 1961, 1541-1552

TEXT: The authors studied the effect of elementary excitations on the energy distribution of neutrons scattered from a ferromagnetic at temperatures far below the Curie point. The differential scattering cross section of unpolarized neutrons may be written in two components, one of which accounts for magnetic single-magnon (spin-wave) scattering (σ_1), the other for magnetic single-phonon scattering (σ_2):

$$\sigma(\mathbf{q}_1, \omega) = \sigma_1(\mathbf{q}_1, \omega) + \sigma_2(\mathbf{q}_1, \omega), \quad (3)$$

$$\sigma_1(\mathbf{q}_1, \omega) = CN\frac{k_2}{k_1}\left(1 + \frac{q_{1z}^2}{q_1^2}\right)[\varphi'_q(\omega) + \varphi''_q(\omega)] \quad (4)$$

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$$\left.\begin{aligned} \varphi_q'(\omega) &= \frac{1}{2\pi}\int_{-\infty}^{\infty} dt e^{-i\omega t}\,\mathrm{Sp}\{b_q(t)\,b_q^+(0)\,e^{-\lambda H}\}\,(\mathrm{Sp}\,e^{-\lambda H})^{-1}, \\ \varphi_q''(\omega) &= \frac{1}{2\pi}\int_{-\infty}^{\infty} dt e^{-i\omega t}\,\mathrm{Sp}\{b_q^+(t)\,b_q(0)\,e^{-\lambda H}\}\,(\mathrm{Sp}\,e^{-\lambda H})^{-1}. \end{aligned}\right\} \quad (5).$$

In these expressions, $\vec{q} = \vec{q}_1 - 2\pi\vec{K}_n$; $\vec{q}_1 = \vec{k}_2 - \vec{k}_1$; $\vec{K}_n$ - vectors of the nodes of the reciprocal lattice. Expressing φ' and φ'' by Green's function one obtains

$$\left.\begin{aligned} \sigma_i'(q_1, \omega) &= \frac{C'N}{\pi}\frac{k_2}{k_1}\left(1+\frac{q_{1z}^2}{q_1^2}\right)\frac{\Gamma_q(\omega)\,N(\omega)}{[\omega-\omega_q-P_q(\omega)]^2+\Gamma_q^2(\omega)}, \\ \sigma_i''(q_1, -\omega) &= \frac{C'N}{\pi}\frac{k_2}{k_1}\left(1+\frac{q_{1z}^2}{q_1^2}\right)\frac{\Gamma_q(\omega)\,[N(\omega)+1]}{[\omega-\omega_q-P_q(\omega)]^2+\Gamma_q^2(\omega)}, \end{aligned}\right\} \quad (10)$$

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for the cross sections of single-magnon scattering (Ref. 2: V. N. Kashcheyev, M. A. Krivoglaz, FTT, v. 3, no. 5, 1961), where σ_1' corresponds to the absorption and σ_1'' to the emission of a magnon by a neutron. The attenuation of a phonon, $\Gamma_{\vec{q}}(\omega)$, its frequency shift $P_{\vec{q}}(\omega)$, and $N(\omega)$ are given by the following expressions:

$$N(\omega)=(e^{\lambda\hbar\omega}-1)^{-1};\quad \Gamma_{\varkappa}(\omega)=\Gamma_{\varkappa 3}(\omega)+\Gamma_{\varkappa 4}(\omega)+\Gamma_{\varkappa sl}(\omega),$$

$$\Gamma_{\varkappa 3}(\omega)=\frac{\pi}{\hbar^2}\sum_{\varkappa'}\Big\{|V_{\varkappa\varkappa'\varkappa+\varkappa'}|^2(N_{\varkappa'}-N_{\varkappa+\varkappa'})\,\delta(\omega+\omega_{\varkappa'}-\omega_{\varkappa+\varkappa'})+$$
$$+\frac{1}{2}|V_{\varkappa'\,\varkappa-\varkappa'\,\varkappa}|^2(1+N_{\varkappa'}+N_{\varkappa-\varkappa'})\,\delta(\omega-\omega_{\varkappa'}-\omega_{\varkappa-\varkappa'})\Big\}, \qquad (11)$$

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$$\Gamma_{\varkappa 4}(\omega)=\frac{2\pi}{\hbar^2}\sum_{\varkappa'\varkappa''}|V_{\varkappa\varkappa'+\varkappa''-\varkappa\varkappa'\varkappa''}|^2\left[N_{\varkappa'+\varkappa''-\varkappa}(1+N_{\varkappa'}+N_{\varkappa''})-N_{\varkappa'}N_{\varkappa''}\right]\times$$
$$\times\delta(\omega+\omega_{\varkappa'+\varkappa''-\varkappa}-\omega_{\varkappa'}-\omega_{\varkappa''})+\frac{6\pi}{\hbar^2}\sum_{\varkappa'\varkappa''}\{|V'_{\varkappa\varkappa-\varkappa'-\varkappa''\varkappa'\varkappa''}|^2[(1+N_{\varkappa-\varkappa'-\varkappa''})\times$$
$$\times(1+N_{\varkappa'}+N_{\varkappa''})+N_{\varkappa'}N_{\varkappa''}]\,\delta(\omega-\omega_{\varkappa-\varkappa'-\varkappa''}-\omega_{\varkappa'}-\omega_{\varkappa''})+3|V'_{\varkappa+\varkappa'+\varkappa''\varkappa\varkappa'\varkappa''}|^2\times$$
$$\times[N_{\varkappa'}N_{\varkappa''}-N_{\varkappa+\varkappa'+\varkappa''}(1+N_{\varkappa'}+N_{\varkappa''})]\,\delta(\omega+\omega_{\varkappa'}+\omega_{\varkappa''}-\omega_{\varkappa+\varkappa'+\varkappa''})\}, \quad (12)$$

$$\Gamma_{\varkappa sl}(\omega)=\frac{\pi}{\hbar^2}\sum_{\mathbf{k}j}\{|V_{\varkappa\varkappa-\mathbf{k}\mathbf{k}j}|^2(1+n_{\mathbf{k}j}+N_{\varkappa-\mathbf{k}})\,\delta(\omega-\omega_{\varkappa-\mathbf{k}}-\omega_{\mathbf{k}j})+$$
$$+|V_{\varkappa+\mathbf{k}\varkappa\mathbf{k}j}|^2(n_{\mathbf{k}j}-N_{\mathbf{k}+\varkappa})\,\delta(\omega-\omega_{\mathbf{k}+\varkappa}+\omega_{\mathbf{k}j})+$$
$$+|V'_{\varkappa\mathbf{k}-\varkappa\mathbf{k}j}|^2(N_{\mathbf{k}-\varkappa}-n_{\mathbf{k}j})\,\delta(\omega-\omega_{\mathbf{k}j}+\omega_{\mathbf{k}-\varkappa})\}, \quad (13),$$

$$P_{\varkappa}(\omega)=P_{\varkappa 3}(\omega)+P_{\varkappa 4}(\omega)+P_{\varkappa sl}(\omega).$$

In the following, the authors study the dependence of Γ and P on temperature and on the wave vector. The attenuation due to spin-spin interaction in cubic crystals is found to be

$$\left.\begin{aligned} \Gamma_\varkappa(\omega_\varkappa) &= \frac{\zeta(5/2)}{32\pi^2\sqrt{2\pi}}\left(\frac{g\hbar}{\mu}\right)^2 v^2\omega_2\varkappa^3\left(\frac{\varkappa_B T}{\hbar\omega_2}\right)^{5/2} \simeq \frac{0.1}{S^2}\frac{\varkappa_B T_c}{\hbar}\left(\frac{\varkappa}{\varkappa_m}\right)^3\left(\frac{T}{T_c}\right)^{5/2}, \\ &\qquad \hbar\omega_\varkappa \gg \varkappa_B T, \\ \Gamma_\varkappa(\omega_\varkappa) &= \frac{1}{48\pi^3}\left(\frac{g\hbar}{\mu}\right)^2 v^2\omega_2\varkappa^4\left(\frac{\varkappa_B T}{\hbar\omega_2}\right)^2 \ln^2\frac{\hbar\omega_A\varkappa^2}{\xi\varkappa_B T} \simeq \\ &\simeq \frac{1}{S^2}\frac{\varkappa_B T_c}{\hbar}\left(\frac{\varkappa}{\varkappa_m}\right)^4\left(\frac{T}{T_c}\right)^2 \ln^2\frac{\varkappa T_c}{\varkappa_m T}. \\ &\qquad \hbar\omega_\varkappa \ll \varkappa_B T. \end{aligned}\right\} \quad (16),$$

where $\zeta(5/2) = 1.341$ (Riemannian zeta function), $\xi \simeq 1$, T_c - Curie temperature, $g = g_0\mu_0\hbar^{-1}$; g_0 - gyromagnetic factor, μ_0 - Bohr's magneton, μ - magnetic moment of the atom, $\varkappa_Б$ - Boltzmann's constant, v - atomic

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volume. The temperature dependence of P is given by

$$P_{\varkappa} = -\frac{\zeta(5/2)}{128\pi\sqrt{2\pi}} \frac{1}{S} \left(\frac{\varkappa_B T}{IS}\right)^{5/2} \omega_{\varkappa} \simeq -\frac{0.04}{S} \left(\frac{T}{T_c}\right)^{5/2} \omega_{\varkappa}. \quad (18)$$

where I indicates the volume integral. In the case of spin-phonon interaction,

$$\left.\begin{aligned} \Gamma_{\varkappa\parallel}(\omega_{\varkappa}) &= \frac{2}{3\pi} \frac{a^4(\varkappa_B T_c)^2}{\hbar^2 \rho c_1^2 \omega_2} (\beta_1^2 + \beta_1\beta_2 + \beta_2^2) \varkappa_B T \varkappa^5, \\ \Gamma_{\varkappa\perp}(\omega_{\varkappa}) &= \frac{a^4(\varkappa_B T_c)^2 \beta_1^2}{\pi\hbar^2 \rho \omega_2^3} \varkappa_B T \varkappa^3. \end{aligned}\right\} \quad (24)$$

holds for high temperatures (T higher than the Debye temperature) and great

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$\varkappa \gg \varkappa_\pi$ ($\varkappa_{\pi\parallel} = \frac{c_1}{\omega_2}$; $\varkappa_{\pi\perp} = \frac{c_2}{\omega_2}$; c_1 and c_2 are the velocities of longitudinal and transverse phonons, respectively). For non-zero temperatures, this expression goes over into

$$\left.\begin{aligned} \Gamma_{\varkappa\parallel}(\omega_\varkappa) &= \frac{16a^4\varkappa_B T_c c_1^3}{3\pi\rho\omega_2^4}(\beta_1+\beta_2)^2 n_{\varkappa j}(n_{\varkappa j}+1)\,|\,\varkappa^4{}_{\varkappa=2\frac{c_1}{\omega_2}} \\ \Gamma_{\varkappa\perp}(\omega_\varkappa) &= \frac{8a^4\varkappa_B T_c c_2^3\beta_1^2}{3\pi\rho\omega_2^4} n_{\varkappa j}(n_{\varkappa j}+1)\,|\,\varkappa^4{}_{\varkappa=2\frac{c_2}{\omega_2}}. \end{aligned}\right\} \quad (25)$$

when $\varkappa \ll \varkappa_\pi$ and $\hbar\omega_\varkappa \ll \varkappa_Б T$; β_1 and β_2 are dimensionless constants of the order of unity. For the same case, the frequency shift has the form

$$P_{\varkappa\parallel}(\omega_\varkappa) = -\frac{\sqrt{2}\,\zeta(5/2)}{\pi^{3/2}}\frac{a^4(\varkappa_B T_c)^2(\beta_1+\beta_2)^2}{\rho c_1^2\hbar}\varkappa^2\left(\frac{\varkappa_B T}{\hbar\omega_2}\right)^{5/2}, \quad T \ll 0.1\frac{T_A^2}{T_c}, \quad (27)$$

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$$P_{\varkappa\parallel}(\omega_\varkappa) = -\frac{4\pi^2}{45}\frac{a^4(\varkappa_B T_e)^2(\beta_1+\beta_2)^2}{\rho c_1 \hbar \omega_2}\varkappa^2\left(\frac{\varkappa_B T}{\hbar c_1}\right)^4, \quad 0.1\frac{T_A^2}{T_e} \ll T \ll T_A, \tag{28}$$

$$P_{\varkappa\parallel}(\omega_\varkappa) = -\frac{4}{9\pi^2}\frac{a^4(\varkappa_B T_e)^2(\beta_1+\beta_2)^2\varkappa_m^3}{\rho \hbar \omega_2 c_1}\varkappa^2\frac{\varkappa_B T}{\hbar c_1}, \quad T > T_A, \; 0.1\, T_A \gg T_e. \tag{29}$$

the corresponding expressions for transverse phonons are obtained from Eq.(27) by the substitutions $(\beta_1 + \beta_2)^2 \longrightarrow \frac{1}{2}\beta_1^2$ and $c_1 \longrightarrow c_2$. There are 15 references: 8 Soviet-bloc and 7 non-Soviet-bloc. The reference to an English-language publication reads as follows: R. J. Elliott, R. D. Lowde. Proc. Roy. Soc., 230, 46, 1955.

ASSOCIATION: Institut fiziki AN LSSR (Institute of Physics, AS Latviyskaya SSR), Institut metallofiziki AN USSR Kiyev (Institute of Metal Physics, AS UkrSSR, Kiyev)

SUBMITTED: November 19, 1960

Card 8/8

S/181/61/003/010/029/036
B125/B102

AUTHORS: Kashcheyev, V. N., and Krivoglaz, M. A.

TITLE: Theory of inelastic neutron scattering from impurity centers in crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3167 - 3180

TEXT: The authors investigate nuclear and magnetic neutron scattering from impurity centers in crystals when scattering is accompanied by electron transitions in these centers. In the case of weak electron-phonon interaction perturbation theory is applied, and in the case of strong interaction of electrons with lattice vibrations the adiabatic approximation is employed. The first section deals with inelastic neutron scattering by a crystal having impurity centers. Electron centers are counted among impurity centers. A general expression for neutron scattering in crystals is derived, and the evaluation of each term is described in detail. The wave function of the system is calculated in adiabatic approximation. If electrons of the center interact weakly with vibrations, then it is possible to apply either the adiabatic approximation or the weak-coupling approximation. After deriving some general relations, the energy distributions of the scattered neutrons are studied. For intense heat release the saddle point method is employed, and the following criteria are valid:

$$M_s = \frac{1}{2} \sum_{x} (\mathbf{q}_1 \mathbf{u}_s(x))^2 \left(\bar{n}_x + \frac{1}{2}\right) \gg 1,$$

$$\frac{1}{2} \sum_{x} [\mathbf{q}_1 \mathbf{u}_s(x) - \mathbf{q}_1 \mathbf{u}_{s'}(x)]^2 \left(\bar{n}_x + \frac{1}{2}\right) \gg 1. \quad (22)$$

In this case, the scattering cross section in adiabatic approximation is given by

$$\sigma(\mathbf{q}_1, \omega) = \frac{m^2}{4\pi^2\hbar^5} \frac{k_2}{k_1} p_1 (I_2 - I_1)^{-2} \sum_{s} (\overline{A_s^2} + \overline{B_s^2}) \left| \sum_{x} x_{12}(x) \mathbf{q}_1 \mathbf{u}_s(x) \right|^2 \times$$

$$\times [2\pi g_s''(0)]^{-1/2} \exp[-\varphi_s(\omega_l - \omega_{lm})]. \quad (23)$$

where $\overline{A_s^2}$ and $\overline{B_s^2}$ denote the values averaged over the isotopes of the atoms in the nodes. The energy distribution of the scattered neutrons

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is Gaussian, and the half-width of the curve is much larger than the phonon energy. With small heat release during neutron scattering production or annihilation of a small number of phonons is most probable. This will occur in the case of weak electron-phonon interaction. The cross section for processes without phonons is calculated first. Then, an expression for a single-phonon process is derived. Both formulas can be applied to a very weak coupling between electrons and lattice vibrations. For processes without phonons the energy distribution of scattered neutrons is determined by a δ - function, which corresponds to emission or absorption of neutron energy equal to the difference between the energy levels of the electrons in the center. The following section of the paper presents an estimate of the parameters of this theory. Magnetic interaction of a neutron with electrons of the impurity center, which is investigated in the last section, will also lead to scattering processes in which the electron state of the center will change. In magnetic scattering the scattered wave will interact directly with electrons of the center. In the case of non-polarized neutrons the cross sections of magnetic and nuclear scattering will add. During magnetic scattering vibrational electron transitions will occur. The magnetic scattering

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cross section in adiabatic approximation is given as
$\sigma_M(\vec{q}_1,\omega) = \sigma_M^o(\vec{k}_2,\vec{k}_1)(1/2\pi i)\int_0 e^{g_o(\omega)}dw$, where $\sigma_M^o(\vec{k}_2,\vec{k}_1)$ denotes the magnetic scattering cross section of neutrons from electrons which are described by the same wave functions as the electrons of the impurity center. There are 8 references: 6 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: O. Halpern, M. H. Johnson, Phys. Rev., 55, 898, 1939.

ASSOCIATION: Institut fiziki AN Latv. SSR Riga (Institute of Physics of the AS Latviyskaya SSR Riga). Institut metallofiziki AN USSR Kiyev (Institute of Physics of Metals AS UkrSSR, Kiyev)

SUBMITTED: June 2, 1961

S/197/62/000/005/001/001
B104/B112

24.7000

AUTHOR: Kashcheyev, V.

TITLE: The effect of anharmonism on the energy distribution of elastically scattered neutrons. II. Four-phonon interaction

PERIODICAL: Akademiya nauk Latviyskoy SSR. Izvestiya, no. 5(178), 1962, 67 - 73

TEXT: The effect which anharmonism of lattice vibrations in an ideal crystal exerts on the peak broadening and on the shift of the maxima of neutrons scattered by phonon interaction is investigated. The contribution of four-phonon interaction to the broadening and shift of the peaks of neutrons scattered by single-phonon interaction is estimated. The phonon damping and the frequency shift of the phonons due to four-phonon interaction of acoustic phonons are examined by using retarded and advanced two-time Green temperature functions. Results and symbols from a previous paper (V. N. Kashcheyev et al., FTT, 1961, 3, 1528) are used.

ASSOCIATION: Institut fiziki Latv. SSR (Institute of Physics of the LatSSR)

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24,7900

S/181/62/004/003/030/045
B108/B104

AUTHOR: Kashcheyev, V. N.

TITLE: Effect of spin-spin and spin-phonon interaction in antiferromagnetics on the energy distribution of scattered neutrons

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 759-771

TEXT: The broadening of the peaks in the energy distribution of neutrons scattered with emission or absorption of one magnon is discussed. The shift of these peaks which is due to interaction of spin waves with one another and with acoustic phonons is also examined. Neutrons are assumed to be scattered from a uniaxial antiferromagnetic single crystal at a temperature which is considerably below the Curie point. In this case one can make use of spin-wave approximation with linear dispersion law. The effect of the conduction electrons is neglected. The Hamiltonian of the considered system in a weak external magnetic field and the general formula for the scattering cross section are derived. The explicit terms for spin-spin and spin-phonon interaction as depending on the wave vector

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S/181/62/004/006/008/051
B125/B104

24.6500

AUTHOR: Kashcheyev, V. N.

TITLE: The theory of slow neutrons scattering from magnetic vibrations in a uniaxial antiferromagnetic

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1432 - 1441

TEXT: The broadening and shift of the peaks of single-phonon magnetic-vibration scattering, which result from magnon-phonon interaction, are investigated. The differential cross section for the single-phonon magnetic-vibration scattering of neutrons is derived from the differential cross section for the magnetic scattering of slow, unpolarized, monochromatic neutrons in the crystal. The energy distribution of coherent single-phonon scattering from nuclei is equal to that of single-phonon magnetic-vibration scattering. This cross section is determined by the functions $\varphi'(\omega)$ and $\varphi''(\omega)$ correspondent to emission and absorption. φ' and φ'' are calculated using retarded and advanced two-time Green functions $G(\omega)$. The differential cross section for the single-phonon scattering of neutrons in an antiferromagnetic is

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$$\sigma_e(\mathbf{q}_1, \omega) = \sum_j \sigma_{ejj}(\mathbf{q}_1, \omega); \tag{16}$$

$$\sigma_{ejj}(\mathbf{q}_1, \omega) = \sigma_{ejj}^{(+)}(\mathbf{q}_1, \omega) + \sigma_{ejj}^{(-)}(\mathbf{q}_1, \omega); \tag{17}$$

$$\sigma_{ejj}^{(-)}(\mathbf{q}_1, \omega) = N\frac{k_2}{k_1}\frac{C|Q_{j\mathbf{q}_1}|^2 + C'|Q'_{j\mathbf{q}_1}|^2}{\omega_{\mathbf{q}j}}\varphi''_{\mathbf{q}j\mathbf{q}j}(\omega) = N\frac{k_2}{k_1}\frac{C|Q_{j\mathbf{q}_1}|^2 + C'|Q'_{j\mathbf{q}_1}|^2}{\pi\omega_{\mathbf{q}j}}\frac{\Gamma_{\mathbf{q}j}(\omega)\,n(\omega)}{[\omega - \omega_{\mathbf{q}j} - P_{\mathbf{q}j}(\omega)]^2 + \Gamma^2_{\mathbf{q}j}(\omega)}; \tag{18}$$

$$\sigma_{ejj}^{(+)}(\mathbf{q}_1, -\omega) = N\frac{k_2}{k_1}\frac{C|Q_{j\mathbf{q}_1}|^2 + C'|Q'_{j\mathbf{q}_1}|^2}{\omega_{\mathbf{q}j}}\varphi'_{\mathbf{q}j\mathbf{q}j}(-\omega) = N\frac{k_2}{k_1}\frac{C|Q_{j\mathbf{q}_1}|^2 + C'|Q'_{j\mathbf{q}_1}|^2}{\pi\omega_{\mathbf{q}j}}\frac{\Gamma_{\mathbf{q}j}(\omega)\,[n(\omega)+1]}{[\omega - \omega_{\mathbf{q}j} - P_{\mathbf{q}j}(\omega)]^2 + \Gamma^2_{\mathbf{q}j}(\omega)},$$

$$n(\omega) = [\exp(\lambda\hbar\omega) - 1]^{-1}; \tag{19}$$

$$\Gamma_{\mathbf{q}j}(\omega) = \gamma^{mf}_{\mathbf{q}j}(\omega) + \gamma^{ef}_{\mathbf{q}j}(\omega) + \gamma^{ff}_{\mathbf{q}j}(\omega); \tag{20}$$

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$\sigma^{(+)}$ corresponds to scattering with phonon emission, and $\sigma^{(-)}$ corresponds to scattering with phonon absorption. $\Gamma_{\vec{q}j}$ describes the broadening, $P_{\vec{q}j}$ the displacement of peaks in the energy distribution of single-phonon neutron scattering as a result of interaction between phonons and magnons (mf), conduction electrons (ef), and phonons (ff) in the scattering antiferromagnetic. When $1 \gg k/k_m \gg H/H_e$, the damping due to the anharmonicity of the phonon-phonon interaction is always weaker than the magnon-phonon damping. Here k_m denotes the maximum value of the magnon wave vector. The field strength $H_e \gg H_o$ characterizes the exchange interaction. Consequently, the broadening of the energy-distribution peaks for the single-phonon scattering of thermal neutrons in uniaxial antiferromagnetics by spin-lattice interaction can be experimentally observed. The most important English-language reference is: A. W. Saenz. Phys. Rev., 119, 1542, 1960.

ASSOCIATION: Institut fiziki AN Latv.SSR, Riga (Institute of Physics of the LatSSR, Riga)

SUBMITTED: December 24, 1961

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39963

S/181/62/004/008/006/041
B125/B104

24,7000

AUTHOR: Kashcheyev, V. N.

TITLE: Theory of inelastic magnetic scattering of slow neutrons from impurity ferromagnetics

PERIODICAL: Fizika tverdogo tela, v. 4, no. 8, 1962, 2037-2046

TEXT: The effect of diamagnetic and paramagnetic impurities on the energy distribution of slow, monochromatic, unpolarized neutrons scattered from a ferrodielectric single crystal was examined. Such impurities give rise to incoherent summands in the single-magnon scattering cross sections, determining the energy distribution of magnetic scattering. The correlation functions $\varphi_{\vec{q}}^{(\pm)}$ in these cross sections are calculated from the Hamiltonian $\mathcal{H} = \mathcal{H}_o + \mathcal{H}_1$ of the system under consideration. $\mathcal{H}_o = \mathcal{H}_{mo} + \mathcal{H}_{fo}$ is the Hamiltonian of the non-interacting magnons ($\mathcal{H}_{mo}$) and phonons ($\mathcal{H}_{fo}$). $\mathcal{H}_1$ describes the interaction of magnons with impurities and phonons, and is

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derived from the Hamiltonian

$$\mathcal{H}-\mathcal{H}_{f0}=\mathcal{H}_{m0}+\mathcal{H}_{mm}+\mathcal{H}_{mf}=-\frac{1}{2}\sum_{n_1,n_2} I_1(r_{n_1n_2})S_{n_1}S_{n_2}-$$

$$-\frac{1}{2}\sum_{l_1l_2} I_2(r_{l_1l_2})\sigma_{l_1}\sigma_{l_2}-\sum_{l_n} I_{12}(r_{l_n})S_n\sigma_l. \qquad (12)$$

of the spin system of the scattering ferromagnetic. Here, $\vec{r}_{n_1n_2} = \vec{r}_{n_1} - \vec{r}_{n_2}$; $\sum_n$ is extended over the lattice sites occupied by the atoms of the ferromagnetic, and $\sum_l$ over those occupied by the atoms of the paramagnetic impurities. After calculating the correlation functions $\varphi_{\vec{q}}^{(\pm)}$ with the aid of the retarded and advanced two-time temperature Green functions one obtains the differential single-magnon scattering cross sections

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24,7200

36305

S/197/62/000/003/002/002
B104/B102

AUTHORS: Bilenskiy, V., Kashcheyev, V.

TITLE: The effect of domain boundaries on slow-neutron scattering in a uniaxial ferromagnetic

PERIODICAL: Akademiya nauk Latviyskoy SSR. Izvestiya, no. 3(176), 1962, 39-43

TEXT: In a uniaxial Co single crystal the thickness δ of the boundary layers between the domains increases faster with increasing temperature than the domain thickness d ($\delta \ll d$). The effect of domain boundaries on neutron scattering is considered. A thermal-neutron beam incident on a face of the single crystal which is parallel to the OYZ plane is considered. The Co single crystal is magnetized in the direction of the OZ axis. A formula of the intensity I_d of the nonpolarized neutron beam passing through a multi-domain sample is derived from the well-known formula of the intensity I of a neutron beam passing through a magnetized sample. Within the limits of applicability of the thermodynamic domain theory $\Delta = 1 - I_\delta/I$ is approximated. $\Delta > 0$. Δ characterizes the difference in

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intensity between a beam having once passed through a single-domain crystal and one having passed through a multi-domain crystal. Δ increases with increasing angle of incidence. Bloch boundaries cause an additional weakening of the neutron beam. Magnetization raises the intensity. With $\delta \ll d$ the formulas of magnetic scattering of single-domain monocrystals may be used for a multi-domain monocrystal. Ye. M. Iolin is thanked for comments.

ASSOCIATION: Institut fiziki AN Latv, SSR (Institute of Physics AS Latviyskaya SSR)

SUBMITTED: June 6, 1961

Card 2/2

KASHCHEYEV, V.

Effect of anharmonicity on the energy distribution of inelastically scattered neutrons. Report 2. Four-phonon interaction. Izv. AN Latv. SSR no.5:67-73 '62. (MIRA 16:7)

1. Institut fiziki Latviyskoy SSR.

(Neutrons—Scattering)

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S/197/62/000/007/001/001
B178/B102

AUTHOR: Kashcheyev, V.

TITLE: Theory of magnetic neutron scattering from a crystal impurity center

PERIODICAL: Akademiya nauk Latviyskoy SSR. Izvestiya, no. 7, 1962, 53-56

TEXT: This article deals with the magnetic scattering of an unpolarized beam of slow neutrons from the electrons of a single impurity center. The scattering is accompanied by a transition of the center from electron state 1 to electron state 2. Using formulas of V. N. Kashcheyeva, M. A. Krivoglaz (FTT, 3, 3167, 1961), O. Halpern, M. H. Johnson (Phys. Rev., 55, 898, 1939), M. A. Krivoglaz and S. I. Pekar (Trudy instituta fiziki AN USSR, 1958, 4, 37), the neutron scattering cross section is estimated for large and small amounts of heat released by the electron transition in the center. The differential scattering cross section per unit solid angle and per unit energy interval of the scattered neutrons is defined by

$$\sigma_m(q,\omega)=\gamma^2 r_0^2 h^{-1}\frac{k_2}{k_1}|F_{12}(q)|^2 . R . \frac{1}{2\pi i}\int_c e^{\varphi(w)}dw. \qquad (1)$$

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where $\gamma = 1.91$ is the magnetic moment of the neutron in nuclear magnetons; $r_o = \frac{e^2}{mc^2}$ is the classical electron radius; $q = k_1 - k_2$, k_1 and k_2 being the neutron wave vectors before and after scattering, respectively; $h\omega$ is the change in neutron energy as a result of scattering; and $F_{12}(q) = \int_\nu \prod d\tau_\nu \sum_\nu \exp(iqr_\nu)\psi_2$. When the dependence of k_2 on ω can be ignored and if q' is given, then

$$\sigma_m(q) = \int \sigma_m(q, \omega)\, d\hbar\omega_l = \gamma^2 r_0^2 \frac{k_2}{k_1} |F_{12}(q)|^2 R. \quad (5)$$

will be valid. Substituting $F_{12}(q) = \sum_\tau C\tau(q_1) f_{12}(q\tau)$, $k_2 - k_1 = q\tau$,

$$\frac{1}{2\pi i} \int_c e^{g(w)}\, dw = \exp\left[-\sum_\varkappa (q_{\varkappa 1} - q_{\varkappa 2})^2 (\bar{n}_\varkappa + \frac{1}{2})\right] \cdot \Phi \frac{L(z)\, dz}{z^{\omega_l + 1}} \quad (7)$$

$$L(z) = \exp\left\{\frac{1}{2}\sum_\varkappa (q_{\varkappa 1} - q_{\varkappa 2})^2 \left[\bar{n}_\varkappa z^{-\omega_\varkappa} + (\bar{n}_\varkappa + 1) z^{\omega_\varkappa}\right]\right\} = \exp[f(z)]. \quad (7')$$

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in (1) gives

$$\sigma_{m0}(q,\omega)=\gamma^2 r_0^2 h^{-1}\frac{k_2}{k_1}|F_{12}(q)|^2\cdot R\cdot exp\left[-\sum_{x}(q_{x1}-q_{x2})^2\left(\bar{n}_x+\frac{1}{2}\right)\right]\cdot\delta(\omega_l). \quad (8)$$

for the magnetic scattering cross section without phonons and

$$\sigma_{m1}(q,\omega)=\frac{1}{2}\gamma^2 r_0^2 h^{-1}\frac{k_2}{k_1}|F_{12}(q)|^2\cdot R.[n(\omega_l)+1]\cdot exp\left[-\sum_{x}(q_{x1}-q_{x2})\cdot\left(\bar{n}_x+\frac{1}{2}\right)\right]. \quad (9)$$

$$\sum_{x}(q_{x1}-q_{x2})^2[-\delta(\omega_l+\omega_x)+\delta(\omega_l-\omega_x)], \quad n(\omega_l)=\left[exp\left(\frac{h\omega_l}{kT}\right)-1\right]^{-1}.$$

for magnetic single-phonon scattering.

ASSOCIATION: Institut fiziki AN Latv. SSR (Institute of Physics AS LatSSR)

SUBMITTED: July 28, 1961

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41735
S/197/62/000/009/001/001
B104/B186

24,7900

AUTHOR: Kashcheyev, V.

TITLE: Theory of magnetic neutron scattering in crystals

PERIODICAL: Akademiya nauk Latviyskoy SSR. Izvestiya, no. 9 (182), 1962, 65 - 71

TEXT: The interaction between spin waves and neutrons, which is one of the reasons for peak-broadening in the single-quantum scattering of slow neutrons in crystals, was investigated in a previous paper (V. N. Kashcheyev, M. A. Krivoglaz.* FTT, 1961, 1541). The Hamiltonian of this magnon-phonon interaction is

$$H_1 = \sum_{k_1 k_2 k_3 j} \left\{ V_{k_1 k_2 k_3 j} b_{k_1}^{+} b_{k_2} a_{k_3 j} \Delta (k_1 - k_2 - k_3) + \right. \tag{1}$$

$$\left. + \frac{1}{2} V'_{k_1 k_2 k_3 j} b_{k_1}^{+} b_{k_2}^{+} a_{k_3 j} \Delta (k_1 + k_2 - k_3) \right\} + \text{s. c.}$$

where b_k^+ is the production operator of a magnon having quasi-momentum hk,

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and a_{kj} the annihilation operator of a phonon having a wave vector k and polarization j. $[b_{\varkappa}, b^+_{\varkappa'}] = \delta_{\varkappa\varkappa'}$; $[a_{kj}, a^+_{k'j'}] = \delta_{jj'}\delta_{kk'}$. The operator (1) is merely the first term occurring when the total spin-phonon interaction Hamiltonian is expanded as a double series, in powers of the relative amounts by which the atomic spin deviates from the direction of spontaneous magnetization, and in powers of the thermal displacement of the atoms from their equilibrium positions. In the present paper, that part of the magnon attenuation, and of the correction to the magnon frequency, is calculated, which relates to the term following H_1 in an expansion of the spin-phonon interaction Hamiltonian in powers of the thermal displacement of the atoms. Together with the formalism of the retarded and advanced two-time Green temperature functions, the following expression is obtained for the magnon attenuation in second perturbation-theoretical approximation:

$$\gamma_{\varkappa} = \frac{\pi}{30}\frac{S^2 Q \varkappa_m^{10}}{\rho^2 c^2 \omega_0}\left(\frac{\varkappa}{\varkappa_m}\right)^5\left(\frac{T}{\Theta}\right)^5, \quad Q = \sum_{l_1 l_2} (A_{l_1 l_2})^2. \qquad (12),$$

if $\Theta_c \gg \Theta \gg T$ and $\Theta\varkappa/T\varkappa_m \ll 1$, where $\varkappa_m$ is the maximum value of $\varkappa$;

$$\gamma_\varkappa = \frac{1}{24\pi^3}\frac{S^2Q\varkappa_m^{10}}{\rho^2c^2\omega_2}\left(\frac{\varkappa}{\varkappa_m}\right)^5\left(\frac{T}{\Theta}\right)^2. \qquad (13),$$

if $\Theta_c \gg T \gg \Theta$; and

$$\gamma_\varkappa = \frac{7\xi(3)}{48\pi^3}\frac{S^2Q\varkappa_m^{10}}{\rho^2c^2\omega_2}\left(\frac{\varkappa}{\varkappa_m}\right)^7\left(\frac{T}{\Theta}\right)^3. \qquad (14),$$

if $\min \frac{\Theta}{T}\left[\left(1-\frac{\varkappa}{\varkappa_m}, \frac{\varkappa}{\varkappa_m}\right)\right] \gg 1$. The correction to the magnon frequency is obtained as

$$p_\varkappa = \frac{\pi^2}{60}\frac{S\varkappa^2\varkappa_m^4}{\rho}\left[\frac{A_{11}}{c_1}\left(\frac{T}{\Theta_1}\right)^4 + \frac{2A_{22}}{c_2}\left(\frac{T}{\Theta_2}\right)^4\right], \Theta_i \gg T. \qquad (19)$$

$$p_\varkappa = \frac{4}{27\pi}\frac{SI\varkappa^2\varkappa_m^4}{\rho v}\left(\frac{4}{c_1}\frac{T}{\Theta_1} + \frac{1}{c_2}\frac{T}{\Theta_2}\right), \Theta_c \gg T \gg \Theta_i. \qquad (20).$$

These terms add on to the expressions obtained in the previous paper for the magnon attenuation Γ and the magnon frequency P, whence:

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$\Gamma_{\varkappa}(\omega) = \Gamma_{\varkappa 1}(\omega) + \gamma_{\varkappa}(\omega)$, $P_{\varkappa}(\omega) = P_{\varkappa 1}(\omega) + p_{\varkappa}(\omega)$. A comparison of $\gamma_{\varkappa}$ with $\Gamma_{\varkappa}$ leads to the physical expansion parameter of the spin-phonon interaction Hamiltonian being expressed by the dimensionless quantity $h\rho^{-1}c^{-1}v^{-4/3}$; ρ is the density, $\varkappa$ the magnon wave vector, Θ the Debye temperature, $\zeta(x)$ the Riemann zeta function, c_1 and c_2 are the velocities of the longitudinal and transverse sound waves, respectively, and $\omega_{kj} = c_j k$.

ASSOCIATION: Institut fiziki AN Latv. SSR (Institute of Physics AS LatSSR)

SUBMITTED: October 21, 1961

Card 4/4

KASHCHEYEV, V.

Role of optical phonons in phonon relaxation. Izv. AN Latv.SSR no.9:49-56 '63. (MIRA 16:12)

1. Institut fiziki AN Latviyskoy SSR.

ACCESSION NR: AP4013748 S/0197/63/000/012/0039/0048

AUTHOR: Kashcheyev, V.

TITLE: On the theory of infrared light absorption in crystals. 5. Absorption in magnetics

SOURCE: AN LatSSR. Izv., no. 12, 1963, 39-48

TOPIC TAGS: spin-phonon interaction, infrared light absorption, magnetic crystal ion, Curie point, spin-wave approximation, Green's function, fourth order anharmonicity

ABSTRACT: The phonon-phonon and spin-phonon interaction effects in the infrared light absorption spectra of magnetic crystal ions (ferromagnetic and antiferromagnetic) have been analyzed theoretically. The absorber-crystal is studied in a temperature range much lower than the Curie point where spin-wave approximations become applicable. Here, as in previous works by the author (FTT, 1963, 5, 1358; 2329), the method of two-dimensional quantum temperature Green's function is used in connection with third and fourth order anharmonicity. For simplicity one of the optically active branches in the infrared absorption band of the magnetic is considered which corresponds to the diagonal branch of the absorption coefficient

ACCESSION NR: AP4013748

$n_{\alpha\beta}(\omega)$. It is shown that the product of fundamental absorption peak height with its half-width is independent of both the temperature and magnetic field. Orig. art. has: 51 equations.

ASSOCIATION: Institut fiziki, AN Latv. SSR (Institute of Physics, AN Latvian SSR)

SUBMITTED: 19Jun63 DATE ACQ: 14Feb64 ENCL: 00

SUB CODE: PH NO REF SOV: 010 OTHER: 003

Card 2/2

S/181/63/005/003/024/046
B102/B180

AUTHOR: Kashcheyev, V. N.

TITLE: Effect of spin-spin interaction on slow neutron scattering in ferrites

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 865-871

TEXT: The present theories of thermal and cold neutron scattering in ferrites take account of spin-spin interactions. The author calculates the contributions of spin-spin interactions to the broadening $\Gamma^{mm}_{pq}(\omega)$ and the shift $P^{mm}_{pq}(\omega)$ of the energy distribution peaks of the single-magnon scattering of slow, monochromatic nonpolarized neutrons in the range $T \ll \Theta_c$ where the spin-wave theory is valid. The scatterer is an isotropic ferrite with two sublattices. The present considerations closely connected with a previous investigation (Kashcheyev, FTT, 5, 909, 1963) from which the basic formulas are taken. For $p = 1,2$ the following results are obtained: Magnon attenuation in the case of small magnon wave vectors q:

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721010015-4"

Effect of spin-spin interaction on ... S/181/63/005/003/024/046
B102/B180

$$qq_m^{-1}\max\left(1, 2\frac{\varepsilon_1}{\varepsilon_2}\right) \ll (\varkappa T)^{1/2}(\varepsilon_2 a^2 q_m^2)^{-1/2},$$

$$\Gamma_{1q}^{mm} = \frac{1}{4\pi^3}\left(\frac{v_1 v_2 q_m^3}{v_1 - v_2}\right)^2 \frac{\varepsilon_1}{\varepsilon_2}\,\frac{\varepsilon_1 a^2 q_m^2}{\varepsilon_{1m}}\left[\frac{\varkappa T}{\varepsilon_{2m}(H_0=0)}\right]^4 F\left(\Lambda, \frac{\mu H_0}{\varkappa T}, \frac{\varepsilon_1}{\varepsilon_2}\right)\omega_{1m}. \quad (13)$$

for large q:

$$qq_m^{-1}\min\left(1, 2\frac{\varepsilon_1}{\varepsilon_2}\right) \gg \left(\frac{\varkappa T}{\varepsilon_2 a^2 q_m^2}\right)^{1/2}.\ \Gamma_{1q}^{mm} \sim \exp\left[-\left(\frac{\varepsilon_1}{\varepsilon_2}\right)^2\left(\frac{q}{q_m}\right)^2\frac{\varepsilon_2 a^2 q_m^2}{\varkappa T}\right]. \quad (15).$$

For the non-activated branch

$$qq_m^{-1} \ll (\varkappa T)^{1/2}(\varepsilon_2 a^2 q_m^2)^{-1/2}$$

$$\Gamma_{2q}^{mm} = \frac{1}{96\pi^3}\left(\frac{v_1 v_2 q_m^3}{v_1 - v_2}\right)^2 \frac{\varepsilon_{2m}(H_0=0)}{\varepsilon_{2m}}\left(\frac{q}{q_m}\right)^2\left[\frac{\varkappa T}{\varepsilon_{2m}(H_0=0)}\right]^3 f\left(\frac{\mu H_0}{\varkappa T}\right)\omega_{2m}. \quad (16)$$

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$$qq_m^{-1} \gg (\varkappa T)^{1/2}(\varepsilon_2 a^2 q_m^2)^{-1/2}$$

$$\Gamma_{2q}^{mm} = \frac{1}{2^{4}\pi^{5/2}}\left(\frac{\nu_1\nu_2 q_m^3}{\nu_1-\nu_2}\right)^2 \frac{\varepsilon_{2m}(H_0=0)}{\varepsilon_{2m}}\left(\frac{q}{q_m}\right)^3 \times \times\left[\frac{\varkappa T}{\varepsilon_{2m}(H_0=0)}\right]^{5/2} Z_{5/2}\left(\frac{\mu H_0}{\varkappa T}\right)\omega_{2m}. \qquad (19)$$

The P_{pq}^{mm} corrections to the magnon frequencies $\varkappa_{pq}$ are

$$P_{1q}^{mm} = \frac{1}{8\pi^{3/2}}\Lambda\frac{\nu_1\nu_2 q_m^3}{\nu_1-\nu_2}\frac{\varepsilon_1 a^2 q_m^2}{\varepsilon_{1m}}\left(\frac{q}{q_m}\right)^2\left[\frac{\varkappa T}{\varepsilon_{2m}(H_0=0)}\right]^{3/2} Z_{3/2}\left(\frac{\mu H_0}{\varkappa T}\right)\omega_{2m}. \qquad (21)$$

$$P_{2q}^{mm} = -\frac{3}{16\pi^{5/2}}v_0 q_m^3\varepsilon_{2m}^{-1}\left[(q_m a_1)^4(u_0^4 I_1 + v_0^4 I_2) + + 2(q_m a_2)^4|I_{12}|u_0^2 v_0^2\left(\frac{q}{q_m}\right)^2\left[\frac{\varkappa T}{\varepsilon_{2m}(H_0=0)}\right]^{5/2} Z_{5/2}\left(\frac{\mu H_0}{\varkappa T}\right)\omega_{2m}. \qquad (24).$$

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It is suggested that the q-, T- and H_o-dependence of Γ^{mm}_{pq} and P^{mm}_{pq} should be found experimentally.

ASSOCIATION: Institut fiziki AN LatvSSR, Riga (Institute of Physics AS LatSSR, Riga)

SUBMITTED: October 24, 1962

Card 4/4

S/181/63/005/003/031/046
B102/B180

AUTHOR: Kashcheyev, V. N.

TITLE: Influence of spin-phonon interaction on slow-neutron single-quantum scattering in ferrites

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 909-920

TEXT: The author calculates the contributions to magnon and phonon frequencies and attenuation due to spin-phonon interaction in an isotropic ferrite with two sublattices, placed in a weak magnetic field $(0,0,H_0)$. The calculations are carried out according to the phenomenological theory of spin waves (UFN, 71, 533; 72, 3, 1960; ZhETF, 38, 1253, 1960) for temperatures $T \ll \Theta_c$, and the results are compared with those of previous investigations (FTT, 3, 1541, 1961; 4, 759, 1962; 4, 1432, 1962) in which the theory of the energy distribution in single-quantum coherent scattering of slow monochromatic neutrons in ferro- and antiferromagnetics had been developed. Relations between phonon and magnon frequencies, attenuation, wave vectors of elementary excitations, temperature, and applied field are obtained and discussed. Particular
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attention is paid to acoustic phonons with arbitrary dispersion law for those directions in the inverse-lattice space for which the oscillations can be divided into longitudinal and transverse. The spin-phonon interaction is found to have an effect comparable with the contributions to phonon attenuation from phonon-phonon interaction, at for instance, small phonon quasimomenta. The magneto-vibrational contribution to peak broadening in the energy spectrum of scattered neutrons is found to be considerable for ferrites with high Debye temperatures and small magnon dispersion.

ASSOCIATION: Institut fiziki AN Latv. SSR, Riga (Institute of Physics AS LatSSR, Riga)

SUBMITTED: September 5, 1962 (initially)
November 3, 1962 (after revision)

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L 14275-63 EWT(1)/BDS/EEC(b)-2/EED-2 AFFTC/ASD/APGC

ACCESSION NR: AP3000614 S/0181/63/005/005/1358/1367

57
56

AUTHOR: Kashcheyev, V. N.

TITLE: Theory of infrared absorption in crystals, considering three-phonon interaction

SOURCE: Fizika tverdogo tela, v. 5, no. 5, 1963, 1358-1367

TOPIC TAGS: infrared absorption, phonon polarization, three-phonon interaction, optical activity, anharmonicity, spectral branch

ABSTRACT: The author derives a general expression for the linear coefficient of light absorption in crystals of arbitrary structure and with any number of optical branches, the absorption being such that its mechanism involves anharmonicity (and the development being restricted to consideration of cubic anharmonic terms). The analysis is effected by means of the two-dimensional Green function (N. N. Bogolyubov and S. V. Tyablikov, DAN SSSR, 126, 53, 1959; D. N. Zubarev, UFN, 71, 71, 1960; and V. L. Bonch-Bruyevich and S. V. Tyablikov, Metod funktsiy Grina v statisticheskoy mekhanike. Fizmatgiz, M., 1961) by an examination of the diagonal contributions (according to indices of phonon polarization) to the absorptions that exist for ionic crystals with more than one "optically active" phonon branch. The

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L 14275-63

ACCESSION NR: AP3000614

author concludes that the values of diagonal and nondiagonal contributions in the region of an edge are of the same order. Orig. art. has: 50 formulas.

ASSOCIATION: Institut fiziki AN LatvSSR, Riga (Institute of Physics, Academy of Sciences, Latvian SSR)

SUBMITTED: 25Dec62 DATE ACQ: 11Jun63 ENCL: 00

SUB CODE: PH NO REF SOV: 010 OTHER: 018

Card 2/2

L 12805-63 EWT(1)/BDS AFFTC/ASD/ESD-3 IJP(C)
ACCESSION NR: AP3000765 S/0070/63/008/003/0333/0337 55 54

AUTHOR: Kashcheyev, V. N.

TITLE: Effect of the spin-phonon interaction inferromagnetic substances on the Debye-Waller factor 21

SOURCE: Kristallografiya, v. 8, no. 3, 1963, 333-337

TOPIC TAGS: spin-phonon interaction, ferromagnetism, Debye-Waller factor, anharmonicity, Hamiltonian, phonon-phonon interaction

ABSTRACT: The Debye factor exp(-W) is computed with full consideration of spin-phonon interaction in ferrimagnetic substances. The investigation results from a need to determine the proper corrections in the Debye-Waller factor that apply to spin-phonon interaction in magnetic crystals. The two computed corrections are shown in Formulas (1) and (2). It is shown that the detected effect (at high temperatures) of spin-phonon interaction on the exp(-W) should be expected in crystals with large spin-phonon coupling and low Debye temperature. This refers only to crystals having acoustical phonon branches. Crystals containing more than a single atom in the unit cell do not admit of having their optical branches measured by results here obtained at temperatures not exceeding the minimal activation energy of optical phonons. Orig. art. has: 29 formulas.

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1964, 777-789

temperature interval. In order

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APPROVED FOR RELEASE: 06/13/2000 CIA-RDP86-00513R000721010015-4"

ACCESSION NR: AP4024332 P/0045/64/025/002/0223/0232

AUTHOR: Kashcheyev, V. N.

TITLE: On the theory of ferromagnetics with helical structures. I. Ferromagnetic spiral

SOURCE: Acta physica polonica, v. 25, no. 2, 1964, 223-232

TOPIC TAGS: helical ferromanetic, unified viewpoint, spin-wave theory, receptivity, spin heat capacity, energy spectrum, umbrella, linear spin wave, hexagonal crystal, crystallographic cell, Bravais lattice, dysprosium, holmium, erbium

ABSTRACT: While the theory of ferromagnetic metals with helical structures has now been farily well worked out, most of the attention has been paid to the conditions of existence of such structures, their stability and conduct under changes in temperature and external field. A systematic examination of a number of them -- rather simple helicoids initially -- is worthwhile from a unified viewpoint, using the spin-wave theory. In fact, a study of the spin-wave (magnon) spectrum, even in rather simple helicoids, leads, as this article shows, to

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ACCESSION NR: AP4024332

important conclusions affecting those values which characterize magnetics: magnetizability, susceptibility, spin heat capacity, etc. The examination of the relaxation processes in ferromagnetics with helicoidal structures, for which V. G. Bar'yakhtar and M. A. Savchenko have already laid the ground (Fizika tverdogo Tela (Solid State Physics), 5, 1158, 1963) is also of special interest. In the present series of articles, the author examines the basic state, energy spectrum and thermodynamic characteristics of a number of simple helicoidal structures: the simple umbrella (ferromagnetic spiral in Kaplan's terminology), slightly and greatly opened umbrellas, umbrella turned inside out, "oblique fence", linear spin wave, -- all uniaxial (hexagonal) crystals with one magnetic ion per crystallographic cell --, thus confining himself for the time being to monocrystals with a Bravais lattice. His general method is illustrated by one of the simple, but rather important structures -- the ferromagnetic spiral such as that of the low-temperature phases of dysprosium, holmium and erbium. Original has 58 equations.

ASSOCIATION: Institut fiziki Akademii nauk Latviyskoy SSR, Riga (Institute of Physics, Academy of Sciences, Latvian SSR)

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ACCESSION NR: AP4024332

SUBMITTED: 17Jul63 DATE ACQ: 15Apr64 ENCL: 00

SUB CODE: ML NO REF SOV: 004 OTHER: 011

Card 3/3

P/0045/64/025/002/0233/0245

ACCESSION NR: AP4024333

AUTHOR: Kashcheyev, V. N.

TITLE: On the theory of ferromagnetics with helical structures and intermingling of the vibration branches

SOURCE: Acta physica polonica, v. 25, no. 2, 1964, 233-245

TOPIC TAGS: ferromagnetic, helicoidal structure, vibration branch intermingling, phonon, magnon, elementary excitation, spiral, energy spectrum, temperature dependence, thermodynamic characteristic, Hamiltonian, Bravais lattice, Bose operator

ABSTRACT: According to theory of co-linear ferromagnetics, the phonon and magnon branches of vibrations in the case of very small wave vectors of elementary excitations are so intermingled that the weakly excited states of the crystal must now be described in terms of some new quasi-particles differing from both phonons and magnons. In the case of magnetics with helical structures, the investigation of the spectrum of long-wave elementary excitations is also of considerable interest. This second part of the paper considers this problem for

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ACCESSION NR: AP4024333

one of the simplest, but practically important, structures -- the ferromagnetic spiral. It derives expressions for the energy spectrum of the system in various phases of this spiral, and, from them, determines the temperature dependence of the crystal's thermodynamic characteristics. Original has 44 equations.

ASSOCIATION: Institut fiziki Akademii nauk Latviyskoy SSR, Riga (Institute of Physics, Academy of Sciences, Latvian SSR)

SUBMITTED: 10Aug63 DATE ACQ: 15Apr64 ENCL: 00

SUB CODE: GE, PH NO REF SOV: 010 OTHER: 011

Card 2/2

KASHCHEYEV, V.N.

Theory of ferromagnetics with helocoidal structures. Pts.3-4. Acta physica Pol 25 no.3:337-358 Mr '64.

1. Institute of Physics, Academy of Sciences of the Latvian S.S.R., Riga.

L 10667-65

L 23778-65 EWT(1)/EPA(s)-2 Pt-10 IJP(c) GG

ACCESSION NR: AP4049391

P/0045/64/026/002/0257/0269

31

B

TITLE: Contribution to the theory of impurity ferromagnetics. Part 1. The case of low temperatures

Acta physica Polonica, v. 26, no. 2, 1964, 257-269

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discussed. The Hamiltonian of a perio...

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ASSOCIATION: Institut fiziki Akademii nauk Latviyskoy SSR, Riga (Institute of Physics, Academy of Sciences, Latvian SSR)

Card 3/3

KASHCHEYEV, V.N.

Theory of ferromagnetics with helicoid structures. Pt.5. Acta physica Pol 26 no.1:11-17 Jl '64.

1. Institute of Physics, Academy of Sciences, of the Latvian S.S.R.